a user interface at which a user generates an input indicating one area of the plurality of areas; and

processing means which receives the input and in response sets the normal value for the linefeed error adjustment parameter to be the value corresponding to the indicated one area of the plurality of areas of the test plot. --

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REMARKS

This amendment is responsive to the Office action mailed June 30, 1999 for the above-captioned application. An objection has been made to Claims 4, 9, 11 and 12. Claim 22 have been rejected under 35 USC 112. Claims 1-4, 6, 7, 9-15 and 18-24 have been rejected under 35 USC 102(b). Claims 4-6, 8-12 and 16-17 have been rejected under 35 USC 103(a). Claims 1, 4, 5, 6, 7, and 9-15 have been amended. No new claims have been added. Claims 2-3 have been canceled. Claims 1, and 4-24 are pending.

Claim Objections

Claims 4, 9, 11 and 12 have been amended to clarify that with regard to the methods of claims 4, 9, 11 and 12 the base claim method is part of a printing method.

Section 112 Rejection

Claim 22 has been rejected under 35 USC 112, first paragraph. The examiner asserts that the specification fails to disclose a sensor that detects media type. This rejection is respectfully traversed. The examiner is directed to page 14, lines 14-18 of the specification, ("In another alternative embodiment one or more sensors are included in the printer to detect the media type, media thickness and/or media stock.

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For example, an optical sensor is included in one embodiment for detecting transparencies.")

Responses to Section 102 Rejections, including the Inventions Distinguished

A. (OA paragraph 5) Claims 1-4, 6, 7, 9-15 and 18-24 have been rejected under 35 USC 102(b) as being anticipated by Erickson (5,592,202)

Erickson discloses a method for calibrating printhead to printhead alignment, such as for a first printhead of one color and a second printhead of another color. In such method an image generated from the first printhead is printed several times and an image generated from the second printhead is printed several times. In the described embodiment the images are printed horizontally across the page as a row of blocks. The blocks from the first printhead are uniformly spaced at one distance, while the blocks from the second printhead are uniformly spaced at a differing distance. Numerous jets and numerous paper advances may be used in printing the rows. As a result of the differing spacing, the blocks from the second printhead line up with those of the first printhead in only one location and extend over each other elsewhere.

According to applicant's invention as claimed in independent claims 1, 7 and 15, a plurality of non-overlapping common images are printed from a given printhead. Accordingly, applicant's invention distinguishes over Erickson by printing non-overlapping images. This distinction is significant allowing applicant's calibration to be implemented with regard to a given printhead, and not just between printheads as achieved by Erickson. In applicant's images, banding occurs within a given image, rather than as overlapping between images. By implementing a method and apparatus in which banding within a single image is perceived and distinguished from banding in other copies of the image, parameters for a single printhead can be calibrated without regard to another printhead.

With regard to claims 4, 6, 9-12, and 18-24, the examiner asserts that Erickson teaches taking into account different media. Applicant respectfully traverses this rejection. Erickson describes a printer which prints onto a print media. Such printer is said to be able to print on different types of media. Thus, in describing the printer, print medium 28 is referred to as paper but may be other types of media. Erickson, however, does not mention print media or paper in describing his calibration method. More significantly, Erickson does not say or suggest that the calibration method may, could or should be performed for different media, or that the results of calibration may differ for differing media. Accordingly, Erickson does not teach or suggest any of the following limitations of claims 4, 6, 9-12 or 18-24:

determining a second value for swath height error adjustment for use in printing onto an identified media type or printing the print job onto a media sheet using the second value for the swath height error adjustment; (as required by claim 4, also see claim 23)

prestoring a set of alternate values for the swath height error adjustment, wherein each one of the set of alternate values corresponds to a different media type; and wherein the step of determining comprises looking up one of the set of alternate values based upon the identified media type; (as required by claim 6, also see claim 24)

deriving a temporary linefeed error parameter value for use in printing onto the identified media type; and printing the print job onto a media sheet using the temporary linefeed error parameter; (as required by claim 9, also see claims 18, 19 and 22)

deriving a linefeed error adjustment value after identifying a media type where the temporary linefeed error adjustment parameter is derived as a function of the normal value and the identified media type; (as required by claim 10)

deriving a linefeed error adjustment value <u>after identifying</u> media thickness, where the temporary linefeed error adjustment parameter is <u>derived as a function of the normal value and the identified media thickness</u>; (as required by claim 11, also see claim 20 where media stock is recited instead of media thickness) or

deriving a linefeed error adjustment value <u>after identifying</u> media finish, where the temporary linefeed error adjustment parameter is <u>derived as a function of the normal value and the identified media finish</u>; (as required by claim 12, also see claim 21).

The examiner recited with regard to claims 13 and 14 that Erickson teaches an input indicating which one area of the plurality of areas has least banding. In Erickson's method banding is not created during the calibration method. Erickson creates shading by overlapping image blocks from two printheads (col. 17, lines 55-59). Banding, however, is a patterned phenomenon occurring within a given image. In particular amended claims 13 and 14 clarify that the banding is a repeating pattern of bands, as distinct from the single overlapped shading of Erickson. Banding as distinct from shading is significant because a banding artifact within a given image enables calibration for a single printhead, rather than among multiple printheads as taught by Erickson.

B. (OA Paragraph 6) Claims 1-3, 7, 13-15 have been rejected under 35 USC 102(b) as used by routines currently used in manufacturing to align, calibrate or adjust printer head assemblies.

The examiner is requested to make specific rejections based upon cited art, not on the examiner's personal experience or conclusions, (e.g., the examiner considers that these claims merely articulate the well known steps of calibrating a device ...).

The examiner does mention that Erickson (5,592,202) and Johnson (5,889,534) are examples. Erickson has been discussed and distinguished above. Johnson like Erickson describes printing of two rows having differing inter-block spacing. Johnson uses the same figure as Erickson (see Johnson Fig. 13 and Erickson Fig. 13) for horizontal alignment of colors. Johnson adds figures to show vertical alignment (see Johnson Figs. 14-15). According to the methods disclosed in both these patents, there is overlapping and shading among blocks. Johnson also indicates that the two rows are for differing colors, but also mentions a variation in which the same printhead may print both rows (col. 13, lines 49-51). This further illustrates the distinction of applicant's invention of using banding within a given image block rather than shading caused by overlapping of adjacent image blocks. Neither Erickson or Johnson discloses that a banding artifact may be generated and used to finely calibrate print control parameters. Specifically, neither Erickson nor Johnson disclose a calibration technique in which a banding artifact is detected and a block/image with a least amount of banding artifact is identified to determine swath height error or linefeed error.

C. (OA Paragraph 7) Claim 1 has been rejected under 35 USC 102(b) as being anticipated by Harrington (5,347,369):

Harrington discloses a method for calibrating gray scale tones of a printer. In printing with black ink, differing gray scale tones (i.e., gray scale levels) are printed like differing colors illustrate an image and distinguish and contrast differing parts of an image. Harrington describes a method for calibrating gray scale levels in which a test chart is printed for comparing halftone sequences of gray level specifications to striped bands of gray level standards. Note that there are no banding artifacts described as being present in the test chart.

In Fig. 1 there are ten gray scale levels being calibrated. For a given gray scale level there is a row of striped bands depicting a given gray scale level standard. Such band is constant across the row. Adjacent to such row is another band in which the gray scale varies across the band. Somewhere across the band the varying gray level corresponds closely to the standard gray scale level above in the adjacent row. The point (referred to as the crossover point) along each given row where the two correspond are selected for each of the 10 gray scale levels. From those selected crossover points, a tone reproduction curve is generated (Harrington Fig. 2). The tone reproduction curve represents the correspondence between the gray level specification of the printer and the actual gray levels produced by the printer. The tone reproduction curve is used to calibrate the printer.

The examiner appears to indicate that an incorrect tone reproduction curve is a banding artifact. Accordingly, this rejection is respectfully traversed. The tone reproduction curve is used to set the gray scale levels of the printer. Such gray scale levels correspond to <u>differing ink densities</u>, not to banding artifacts or banding artifacts attributable to line feed errors or swath height errors. Accordingly, Harrington does not relate to calibrating away undesired banding artifacts, nor for calibrating line feed error or swath height error. Further, Harrington does not disclose or suggest the following additional claim 1 limitations:

printing ... a test plot having a plurality of non-overlapping areas, <u>each area being a common image</u> printed using a different value of the swath height error adjustment; or

receiving an input indicating for which one area of the plurality of areas the common image <u>exhibits either the absence of or the least amount of the banding artifact</u> within said common image as perceived by a person viewing the media.

Section 103 Rejections

A. (OA Paragraph 9) Claims 8, 16, and 17 have been rejected under 35 USC 103(a) as being unpatentable over Erickson in view of Harrington (5,627,572) and further in view of Heeren (5,321,437)

The examiner indicates that Harrington '572 teaches the storing of maintenance algorithms. Harrington '572 at col. 1, lines 23-28 describes maintenance of an ink-jet printhead as being a combination of firing the nozzles, wiping the nozzle plate and sealing the environment around nozzles to clear the nozzles, remove ink and debris and prevent ink from drying in the nozzles. However, such procedures or algorithms are unrelated to calibration procedures and algorithms and more particularly are unrelated to linefeed error calibration. Further such procedures do not teach or suggest that it is possible or desirable to alter calibration values for line feed adjustment for a given print job.

Heeren discloses a printing method in which an image is exposed on a photoconductive drum. The image is developed with a toner material and transferred to a media sheet. A transfer device, a metal roller, receives a voltage for transferring the toner powder image from the photoconductive drum to the media sheet (col. 3, lines 5-19). Image transfer is synchronized by identifying the displacement of the media sheet over a known distance while situated in the transfer device (col. 3, lines 43-45). Such identified displacement triggers generation of a pulse used to derive a synchronization value (i.e., line frequency at which image data is fed to LED array for image exposure and development to correspond to image transfer) (col;. 3, lines 45-49). As a result of measuring the displacement, even when the transfer device roller wears, synchronization is maintained (col. 3, lines 25-34). However, Heeren does not track the life of the roller, nor maintain a schedule estimating the roller life cycle.

With regard to claim 8, none of Erickson, Harrington or Heeren disclose a printer which includes a life cycle schedule for a roller or which varies a linefeed parameter automatically with a life cycle schedule of roller wear.

With regard to claim 16, none of Erickson, Harrington or Heeren disclose a printer which tracks use of a printer or which varies a normal value of a linefeed error parameter value as a function of the tracked usage.

With regard to claim 17, none of Erickson, Harrington or Heeren disclose a printer which tracks life of a roller, or which varies a normal value of a linefeed error parameter value as a function of the tracked life.

B. (OA Paragraph 10) Claims 4-6 and 9-12 have been rejected under 35 USC 103(a) as being unpatentable over routines currently used in manufacturing .. as applied to claims 1 and 7 and further in view of DeLacy (4,734,868) and Suzuki et al. (5,717,977).

The examiner indicates that currently used methods teach generic calibration for banding parameters. The examiner is requested to specify such generic calibration methods and identify what is meant by the examiner's coined term - banding parameters. To the extent the examiner is referring to the Erickson and Johnson teachings in regard to calibration methods, the same comments as applicant made above with regard to the section 102 rejections apply here.

DeLacy discloses a paper transport system in which demarcations on the paper (e.g., sprocket holes; inked markings) are detected to precisely determine paper position. DeLacy distinguishes over a prior system in which paper advance was based on absolute distances measured between demarcations. A problem with the art cited by DeLacy was that changes in the registration of the paper (e.g., such as due to changes in sprocket holes by tearing or stretching) resulted in banding. In DeLacy each print

line is registered relative to the latest demarcation to avoid the accumulated errors. By providing such measurements during printing, a differing velocity for a differing print job will not accumulate an error. DeLacy discloses that media of differing thickness will have a differing velocity, (i.e., because drive radius is measured from the center of the roller to the centerline of the media, papers of differing thickness are acted upon with a differing drive radius and thus experience a differing transport velocity). Factors causing a differing velocity, including the factor of differing media thickness, therefore are factored out. If such velocity differential is not accounted for, an accumulated error (perceived as banding) may result in the prior art device.

DeLacy avoids the accumulating error by placing each line of print relative to a measured demarcation position. DeLacy, however, does not disclose that swath height error or linefeed error is affected by variations in paper thickness. DeLacy only discloses that media transport velocity is affected. More specifically, DeLacy does not disclose or suggest identifying the type of media, determining a swath height error correction or linefeed error adjustment based on the type of media, and applying that correction for the corresponding print job (as required by claims 4 -6 and 9-12). Further DeLacy does not disclose prestoring a set of alternative values for each one of a differing media type (as required by claim 6).

Suzuki discloses an image forming apparatus in which a toner image is developed on a photosensitive drum by a charging device and one of two developing devices. A transfer apparatus is used to transfer the toner image onto a media sheet. The transfer apparatus includes a transfer drum, a transfer charging device, an adsorbtion charging device, an adsorbtion roller, an inside charging device, and an outside charging device. The media sheet is separated from the transfer drum by functions of a separating nail, a separation push-up roller, and a separation charging device.

Of significance to these remarks are that for different media the transfer process may vary. In particular, the fixing speed and the transfer current may vary (col. 5, lines 12-14). As a result, the printer allows the operator to select which type of media is being printed for manual feed operations. The printer also allows the operator to designate a specific input tray as having a particular type of media. In the case of OHP (i.e., transparencies) the printer also inhibits two sided printing. The examiner recites Suzuki as teaching temporary settings for different media. However, in Suzuki these temporary settings do not relate to inkjet techniques or even to synchronizing media transport with ink ejection. They relate to the differing requirements in a transfer charge device for getting toner to stick to different media (e.g., transparencies, thick sheets).

Suzuki does not disclose or suggest determining a swath height error correction or linefeed error adjustment as such errors relate to inkjet printhead techniques. Further, Suzuki does not disclose or suggest determining such an error correction for a given print job based on the type of media, or applying that correction for the corresponding print job (as required by claims 4 -6 and 9-12). Further Suzuki does not disclose prestoring a set of alternative swath height error or linefeed error adjustment values for each one of a differing media type (as required by claim 6).

Conclusion:

In view of the above remarks regarding the cited art, it is respectfully submitted that no such combinations of the cited art as offered by the examiner would result in the present invention. It is also respectfully submitted that the claims contain key limitations that are not present in the cited art and not obvious from the cited art. These particular limitations, are not disclosed in or suggested by any of the cited references. These limitations are significant advances over the prior art and resulted in a

novel method and apparatus for calibrating linefeed error adjustment and swath height error adjustment, and for printing based upon such calibrations and changes to such calibrations.

In view of the above remarks and amendments to the claims, it is respectfully submitted that the claims are now in condition for allowance. The Examiner's action to that end is respectfully requested.

If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the application, the Examiner is invited to call the undersigned attorney at the telephone number given below.

Respectfully submitted,

Dated: 9/15/99 By: Steven P. Koda

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